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ABSTRACT

Reported is a study of the effect of participation in an inquiry activity compared to a reading activity on learning and retention. The subjects were (1) a group of 23 inservice teachers in a six-week summer class, and (2) a group of 31 inservice teachers in an eleven-week college term. The classes were each randomly assigned to two groups of approximately equal size. One group was directed to use the library for texts and references to study about pendulums. The other group used materials from the Elementary Science Study unit on pendulums, collecting data and analyzing the results of their inquiry activity without teacher direction. In both groups, pre- and posttests were used to determine the amount of learning. Superior learning experience was shown for the activity groups as compared to the reading groups. Retention of learned concepts indicated a significant advantage for the activity group in the six-week class but no significant differences were noted between the groups in the eleven-week term. (EB)

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A STUDY OF THE EFFECTS OF A READING METHOD VS. AN ACTIVITY METHOD ON THE LEARNING AND RETENTION OF SIMPLE CONCEPTS DEALING WITH PENDULUMS

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Introduction

Encountering graduate students in Modern Trends in the Teaching of Elementary Science, term after term, gives one much food for thought concerning some of the problems of teaching elementary school teachers to teach. One of the postulates that has sifted down from Educational Psychology is that activity on the part of the learner is preferred to passivity. Both the 31st[7] and 59th[8] Yearbooks of the National Society for the Study of Education stress the active involvement of children in their learning. A plethora of science educators have advocated the activity approach; and the newer national curricula reflect this point of view, particularly the elementary science education curricula.

This type of learning has been advocated in the Shippensburg State College graduate science education courses for many years. The inservice teachers are guided through a number of activities which gives them a look at viable national curricula such as Science-A Process Approach, Science Curriculum Improvement Study, and Elementary Science Study. The students do activities from each program as part of the course. Butts and Hall[9] state in the instructors' guide to The Teaching of Science-A Self Directed Learning Program that, "a teacher . . . cannot be interested in that which is unknown to him," and "Commitment to the active use of the tasks in the classroom is essential." Matthews, Phillips and Good[5] emphasize activity in learning in their introduction to Student-Structured Learning in Science.

Telling students that these educators are enlightened, assigning references that substantiate this, and discussing how children learn best just did not seem to be as effective a learning situation as might be designed. With this problems in mind and remembering the words of Dutton[4], that teachers teach as they were taught, the idea for this research grew.

The author emphasizes to students that our work in the classroom has two primary objectives; (1) to help children learn and (2) to help children retain what they have learned. The research described herein was a simple attempt to involve the students (inservice teachers) in an actual test of two methods of learning. The students were the subjects. It was hoped that having action research applied to the students themselves would establish a disposition favorable to their investigating other research that might help them in their teaching and also be effective motivation to help them see the importance of using inquiry activities to teach science in their classrooms.

Other studies comparing teaching methods have been accomplished. Drenchko[3], in reviewing many of these studies, points out that few statistical advantages have been found.

Other studies by Babikian [2], Alterman[1], and Menzel[6] lend support to the idea that one method of instruction is not statistically superior to another.

Problem

Talking and reading about better ways to teach elementary school science is no guarantee that students will apply these techniques in their classrooms when they teach. New elementary science curricula advocate strongly the role of activities in the development of children's learning. This study was planned to confront graduate students in an elementary science education course, first hand, with a research study concerning two methods of learning.

Two research questions were developed.

(1) Does participation in an inquiry activity promote better learning and retention than a reading activity in some simple concepts concerning the pendulum?

(2) Does participation in action research that supports one mode of learning cause participants to use that mode in their teaching?

Description of the Study

Two intact graduate elementary science classes at Shippensburg State College, Shippensburg, Pennsylvania, were used in the study: (1) a group of twenty-three inservice teachers in a six weeks summer class, and (2) a group of thirty-one inservice teachers in an eleven weeks term.

Prior to the first session the names on the class lists were randomly divided into two groups of approximately the same size. A short examination on pendulums was constructed, (See Appendix A). This test was given to the members of each class shortly after their entry on the first day of class. No preparation was allowed and no advance warning was issued. The classes were then divided into the two groups as selected randomly. One group was directed to use the college library to study about pendulums employing the texts and references of the curriculum library for the next hour. The library was located relatively close to the classroom. The other group remained in the classroom and used the materials from the Elementary Science Study unit on pendulums. They collected data and analyzed the results of their inquiry activity without teacher direction.

Both groups were then brought back into the classroom, and a post-test was given. The pretest, posttest, and post-posttests were identical. During the following class session the results of this data were shared with the students. The postulate that "activity on the part of the learner is preferred to passivity" was discussed. The fact that the newer national curricula in elementary science education advocate this

point of view and reflect this postulate in the construction of these curricula was explained.

No further reference to these tests or the pendulum activity was made during the remaining portion of the term. At the next to last session of the class, a post-posttest was given to secure data regarding the retention of knowledge concerning pendulums.

A follow-up study, using an informal observation/discussion approach, was planned to gather data concerning research question two, essentially whether participants changed their teaching mode.

It was the reasoning of the researcher that if the action research had promoted changes toward greater use of inquiry activities by participants that, since no base line observations were made, this data would have to be supplied by the participants themselves.

Questions concerning the participants' use of inquiry activities prior to and since the in-service class were designed to be used in the observation/discussion sessions.

The Findings

The pretest, posttest, post-posttest sequence yielded sufficient data to analyze the first research question: Does participation in an inquiry activity promote better learning and retention than a reading activity in some simple concepts concerning the pendulum.

The following tables and discussion summarize the statistical data for the two classes on the three measures that were made. Pretest, posttest, and post-posttest comparisons were made between the Reading (R) group and the Activity (A) group using the t-test.

Table I

Means, Standard Deviations, Degrees of Freedom, and t-Values for Six Weeks Group

Group Comparisons		Pretest	Posttest	Post-posttest
Reading Group Mean	$\bar{R}$	1.727	5.363	5.090
Activity Group Mean	$\bar{A}$	1.500	6.000	6.000
Standard Deviation	S_R	1.489	0.809	1.136
Standard Deviation	S_A	1.167	0.000	0.000
Degrees of Freedom	df	21	21	21
t-value	t	0.409	2.730	2.777

The table value for t at twenty-one degrees of freedom and alpha level of 0.05 is 2.080. The posttest and post-posttest comparisons indicate a significant difference in the scores for the two groups. The activity group achieved significantly higher than the reading group on these measures. The pretest comparison indicates no significant difference between the two groups on this test prior to the treatment. Learning and retention on the part of the activity group appears to be significantly better as indicated by the data collected immediately after the activity and six weeks after the activity.

Table II

Means, Standard Deviations, Degrees of Freedom, and t-Values for Eleven Weeks Group

		Group Comparisons		
		Pretest	Posttest	Post-posttest
Reading Group Mean	$\bar{R}$	2.062	4.562	4.250
Activity Group Mean	$\bar{A}$	1.533	5.400	4.600
Standard Deviation	S_R	1.236	0.813	1.183
Standard Deviation	S_A	1.505	0.507	1.804
Degrees of Freedom	df	29	29	29
t-value	t	1.072	3.410	0.642

The table value for t at twenty-nine degrees of freedom and alpha level of 0.05 is 2.045. The posttest comparison indicates a significant

difference. The activity group scored significantly higher on the pendulum posttest than did the reading group. The post-posttest does not give a significant difference. Though the activity group mean was greater than the mean of the reading group, it was not as great a difference as at the posttest.

The second research question: Does participation in action research that supports one mode of learning cause participants to use that mode in their teaching?, was not fully researched. Three of the school districts from which a large portion of the sample population was obtained purchased new science curricula for their elementary schools in the school year following the class.

The informal follow-up indicated that a majority of the subjects are using more inquiry activities in their classrooms than they were in the past. However, the introduction of new elementary science curricula utilizing the inquiry approach into many of the participants' classrooms probably had a greater impact on their use of these activities than did the graduate class.

Such extenuating circumstances made continuation of the follow-up study implausible.

Discussion and Conclusions

Two research questions were investigated using intact graduate classes in the course, Modern Trends in the Teaching of Elementary Science. The two questions for which data were collected were:

(1) Does participation in an inquiry activity promote better learning and retention than a reading activity in some simple concepts concerning the pendulum?, and,

(2) Does participation in action research that supports one mode of learning cause participants to use that mode in their teaching?

In both the six week and eleven week groups the amount of learning that took place as indicated by posttest scores shows a superior learning experience for the activity group as compared to the reading group.

Post-posttest scores that reflected the retention of learned concepts indicates a significant advantage for the activity group in the six week group, but no significant difference with the eleven week group.

The follow-up study to investigate question two was not completed. Some of the school districts in which participants taught adopted new, inquiry oriented, elementary science curricula that year. One district also held an inservice workshop to familiarize the teachers with the new approach and the materials.

The participants of this study were involved in a positive example of the use of inquiry activities in teaching science. Many teachers began using inquiry activities; others used them more often than they had. Whether or not other teachers made immediate use of this mode of teaching in their classrooms, they may be more prone to change if and

when their districts adopt one of the new science curricula.

The participants of this study not only were involved with an activity from one of the newer curricula, but were particle to research that supported such a mode of learning. If we teach as we were taught, perhaps some experimentation with methodology will be forthcoming from the participants of this study.

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Name _____

Class _____

Date _____

PENDULUMS

1. If you were to suspend a weight, such as a large wooden ball, from a string and then swing the weight slightly back and forth, you would find that it swings to and fro in regular time. What would happen to the frequency (the number of swings per given amount of time, i.e. counts/minute) if you made the pendulum swing in a longer arc without changing the length of the string?

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2. What generalizing statement can you make about the length of the arc and its effect on the period (time for a full swing) of the pendulum?

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3. How would a change in the amount of weight of your pendulum (bob) effect the period of the pendulum? (For instance, if the wooden ball were replaced with a steel ball of the same size) Assume that there is no change in length.

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4. What generalizing statement can you make about the weight of the pendulum and its effect on the period of the pendulum?

5. How would a change in the length of the string supporting the pendulum (bob) effect the period of the pendulum? If you doubled it? If you tripled it? If you halved it?

6. What generalizing statement can you make about the length of the string (length of pendulum) and its effect on the period of the pendulum?